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Virtual Environments for People Who Are Visually Impaired Integrated into an Orientation and Mobility Program

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Structured abstract: *Introduction:* The BlindAid, a virtual system developed for orientation and mobility (O&M) training of people who are blind or have low vision, allows interaction with different virtual components (structures and objects) via auditory and haptic feedback. This research examined if and how the BlindAid that was integrated within an O&M training program could be of help when teaching those who are blind or visually impaired to develop O&M skills. *Methods:* Using qualitative and quantitative methods, this research focused on 16 participants during their O&M course, and studied virtual environment exploration and orientation tasks in virtual environments. *Results:* The encouraging results of the current study indicate the potential strengths of the BlindAid system as an O&M training device for visually impaired people. *Discussion:* Follow-up research evaluating transference of knowledge from virtual environments to real spaces could contribute to O&M training for people who are visually impaired. *Implications for practitioners:* BlindAid could play a central role in three potential applications: a training simulator for O&M, a diagnostic tool for O&M specialists to track and observe participants' spatial behavior, and a technique for advanced exploration of unknown spaces.

People who become visually impaired face great difficulties and limitations in independent travel in the process of losing sight. Orientation and mobility (O&M) courses support the acquisition of O&M skills by supplying perceptual and conceptual information. Perception through touch, auditory, and olfactory senses helps compensate for the shortage of visual information. Amendola (1969) based his pioneering work in sensory training (Campbell, 1992a, 1992b) on the systematic collection of information from the immediate environment through all five senses. Conceptually, the focus of such training is in

This research was partially supported by a grant from the NIH-NEI (Grant No. 5R21EY16601-2), and was partially supported by The European Commission, Marie Curie IRG (Grant No. FP7-PEOPLE-2007-4-3-IRG). We acknowledge the Carroll Center for the Blind, Newton, Massachusetts, for collaboration and support during the BlindAid design and research. We thank our anonymous participants for their time, efforts, and ideas.

supporting the development of appropriate orientation strategies to achieve efficient cognitive mapping of a space, and in applying that mapping during navigation. Jacobson (1993) described teaching strategies for familiarizing oneself to indoor environments, first by perimeter strategy (walking along the room's walls), and then by grid strategy. Research on spatial models showed that blind people mainly use the route model when exploring and navigating spaces (Fletcher, 1980). The *route model* is based on linear recognition of spatial features, and the *map model* is holistic, encompassing multiple perspectives of the target space. Research on construction of cognitive maps (Tversky, 1992) found that categorization often aids memory. Lahav and Mioduser (2008) found similar results in research on the construction of cognitive maps by people who are visually impaired.

Researchers who focus on virtual environment haptic technologies for blind people, including identification of texture and shape recognition (Sjotrom & Rassmus-Grohn, 1999) and mathematical learning environments (Yu, Ramloll, & Brewster, 2001), have reported their potential for supporting learning. Research on the acquisition of spatial information of unknown spaces through sound-based virtual environments (Sánchez, Noriega, & Farías, 2008, March; Seki & Sato, 2011) showed that users required strong attention to auditory feedback. Technological advances in haptic interface technology have enabled blind people to explore new spaces and thus expand their spatial knowledge (Lahav & Mioduser, 2004; Parente & Bishop, 2003). These research results validated the potential of virtual environments for O&M based on haptic and audio feedback.

This research was conducted by the researchers at the Carroll Center for the Blind, Newton, Massachusetts, which offers a number of programs for people who are visually impaired (that is, those who are blind or have low vision) involving O&M instruction. Included in this study were participants attending two of these programs: an 8- to 12-week independent living program and a 5- to 6-week transition from school to college program. After a two-week assessment, O&M specialists recommended training in seven areas: nonvisual O&M training, cane techniques, indoor travel, outdoor travel, orientation, street-crossing techniques, and public transportation use. The current study used BlindAid to simulate training environments for the first five of the recommended skill areas.

This study is part of a larger research effort comprising the design, development, and evaluation of a virtual environment system that does not provide visual information to users (Lahav & Mioduser, 2008; Lahav, Siddarth, Schloerb, & Srinivasan, 2008). BlindAid was developed to allow totally blind individuals or blindfolded people with low vision to explore unknown spaces in advance. The BlindAid system provided the virtual environments that the participants explored in this experiment (see Figure 1). The BlindAid application software runs on a personal computer (Pentium 4, 2.8 GHz) running Windows XP and equipped with a haptic

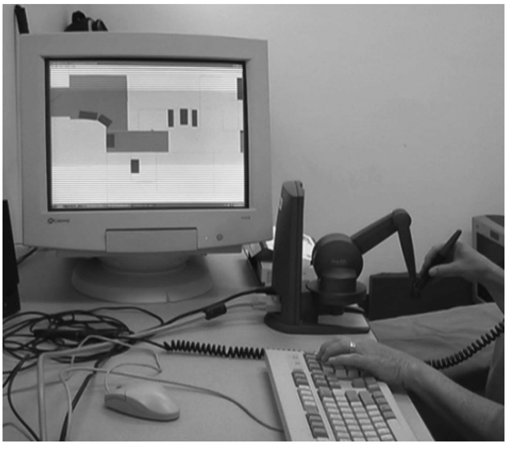

Figure 1. BlindAid user interface.

device (SensAble Technologies, Desktop Phantom) and stereo headphones (Sennheiser, HD580). A simple graphic display allows sighted persons to observe the user's movements in the virtual environment.

With the Phantom haptic device, users control the position of their avatar within the virtual environment and receive haptic feedback about the space through the stylus. Spatialized audio allows users to hear the direction and distance of virtual sound sources to maintain orientation in the virtual environment. Background sounds (for instance, the sounds in a cafeteria) play automatically whenever the avatar is within specified regions of the virtual environment.

Each component of the virtual environment is represented haptically and auditorially. For example, the user feels a virtual floor with a range of haptic properties (for instance, tile, marble, or rubber); each floor has a different degree of stiffness and texture feedback: hard, bouncy, smooth, or rough. Virtual objects also have different sounds. When the avatar contacts an object, the system plays a distinctive sound representing the virtual object through nonverbal "real space" sounds, nonverbal artificially synthesized sounds, or a short verbal description. Pressing a specified key yields more detailed audio information about the objects. Research results on the haptic stylus interaction and further technical details about BlindAid system appeared in Lahav, Schloerb, and Srinivasan (2012).

The main goal of this study is to evaluate the integration of BlindAid in an O&M course. Students may benefit from extra practice of the O&M skills they are learning during O&M sessions without expending the mental and emotional sensitivity needed to explore real spaces.

To our knowledge, this research presents the first virtual environment system to support an O&M course for visually impaired people. To evaluate the implementation of BlindAid into an O&M course and to examine its support for real space orientation performance, this research examined two questions:

1. What were the participants' cognitive mapping characteristics in the experimental and control groups?
2. How well did the two groups perform orientation tasks in the real environments?

Methods

Participants

Sixteen participants were selected based on five criteria. They needed to be: enrolled in one of the two programs at the Carroll Center, in a program that included O&M training, have no additional disabilities, able to speak English, and able to use computers. We defined two groups: experimental and control.

Experimental group

The experimental group comprised 11 participants who received additional training during their O&M course using the BlindAid system. Two participants who began the program were later excluded (one was unwilling to continue with the experiment; the second left the center). Of the nine remaining, six were from the Independent Living Program and three from the Transition to College Program. Participants' age range was 18 to 66 years; seven were female; three were congenitally blind; eight were adventitiously blind, three of whom were newly blind (they had become blind within two years of the beginning of the research period or had a prognosis of loss of vision). Three participants were totally blind; six had low vision and were blindfolded (in the O&M course and BlindAid training); seven were students or employed. Five were long cane users before their arrival at the Carroll Center, and four began use of the long cane there.

Control group

The control group included five participants who were enrolled in the O&M course and received no additional training. Four were from the Independent Living Program and one was from the Transition to College Program. The age range was 18–48 years and included four females; two were congenitally blind; three were adventitiously blind, two of whom were newly blind; two were totally blind and three were blindfolded. Two were long cane users before their arrival at the center and three began long cane use there.

Researchers assigned the participants randomly to the research group without any advance knowledge about them. The O&M questionnaire results of the participants showed no O&M ability differences in familiar indoor environments or in unfamiliar indoor or outdoor environments. Differences in ability were found in familiar outdoor environments—most of the experimental group preferred using a long cane, while most of the control group preferred being accompanied by a sighted person.

Variables

The variables have been defined in previous research (Lahav & Mioduser, 2008). Two groups of dependent variables were defined as follows.

Cognitive map

Participants' prior spatial cognitive map included seven variables: structural components (such as a door); structural component location; objects (such as a table); object location; spatial strategy: perimeter, object-to-object, item list (a list of an environment's components) or starting-point perspective descriptions; spatial model: route model, map model, or item list (a list of environment's components); and chronology of the descriptive process.

Real space orientation tasks performance

Performance on orientation tasks in real space included six variables: duration; spatial strategy; task completion (that is, failed, arrived at the target zone with verbal assistance, arrived at the target zone, or successful); type of path: wandering around, indirect, direct with limited wandering, and direct; using the second hand to discover the properties of the immediate surroundings to support orientation; and

orientation problem-solving strategies (that is, object landmark, ground landmark, audio landmark, cardinal direction, verification of starting point, reversing to starting point, travel for more spatial information, and stopping and thinking about the available spatial information).

Implementation tools

Simulated environments

O&M instructors and the researcher chose nine spaces on the Carroll Center campus (the areas the O&M course used most often) that were modeled as virtual environments: four main building floors, four dormitory floors, and the Carroll Center campus itself.

Real space orientation tasks

O&M instructors helped the researcher to design real space orientation tasks resembling O&M course tasks. The participants performed 9 to 10 orientation tasks: 2 two-part object-oriented tasks (find an object, then "reverse" to start); 2 two-part perspective-taking tasks (go from location A to location B, then reverse); and a pointing task indicating the location of 5 to 6 different objects from the start.

Data collection tools

O&M questionnaire

Each participant answered 50 questions about their O&M abilities indoors and outdoors in familiar and unfamiliar environments (Dodson-Burk & Hill, 1989; Lahav & Mioduser, 2004; Sonn, Tornquist, & Svensson, 1999).

Pre-exploration verbal description

At the beginning of each session, participants gave descriptions of the real space; these were videorecorded and transcribed.

Observations

Observations of participants performing their real space orientation tasks were videorecorded and transcribed.

Data analysis

To evaluate performance, we applied two coding schemes (prior spatial knowledge and real space orientation task performance) that were primarily developed in previous research studies by four O&M instructors (Lahav & Mioduser, 2004, 2008). All videorecordings were coded using Interact qualitative statistical software.

To assess the validity of the data, an O&M instructor who was not employed by the Carroll Center analyzed the videos of 17 real space orientation task performances (indoor and outdoor spaces). Interjudge reliability was 93% and was therefore considered reliable.

Based on a pilot study examining all nine spaces, we chose cluster-sampling methodology for this research (Lahav et al., 2012). We examined, coded, and analyzed the participants' orientation tasks in four of the nine spaces—three indoor environments and one outdoor environment. We examined the first space—main building, third floor (M3); the third space—main building basement (MB); the seventh space—dormitory basement (DB); and the ninth space—the campus of the Carroll Center for the Blind (CCB campus; sessions CCB1 and CCB3).

Procedure

Throughout the BlindAid training we observed all participants individually. During all research sessions, participants in both groups continued their individual O&M courses. This research involved participants with low vision who had been

asked by their O&M instructors to wear blindfolds during the training program, and they were also blindfolded during BlindAid sessions. In the first session, participants completed consent forms and an O&M questionnaire. Next, the experimental group had two sessions learning to operate the BlindAid system. Each of the remaining sessions was dedicated to one of nine environments. The research spaces increased in complexity (shape, size, structures, and objects) from simple (M3) to complex (CCB campus). At the start of each session all participants described the targeted real space. The experimental group then explored the simulated environment using BlindAid. Last, all participants performed orientation tasks in the real space. The control group had no additional exploration sessions. All participants explored and walked in these real spaces during everyday activities, including in the O&M training program. The BlindAid sessions lasted 20 minutes (control group) or 50 minutes (experimental group), with two to three sessions per week.

Integrating BlindAid into the O&M course as a research project had positive and negative effects. Since the participants stayed at the Carroll Center only for the duration of their O&M program, the center's timetable dictated the length of each session and the research process.

Results

Research question 1

All participants in both groups started every session by verbally describing the targeted real space. Description percentages were calculated based on the number of components the participants described (structure and objects and their location) out of the total number of components present in that space. No main differences were found between the two research groups. Both groups provided poor average verbal descriptions in M3 and MB (12% to 24%). In DB the participants included more components (experimental 47%, control 52%), while their CCB campus descriptions included fewer components (experimental 38%, control 35%). In all research spaces, all participants gave more details about structural components. For example, in M3 experimental participants included 29% of available information about structural components and only 1% about objects. Over time, participants' description of components increased.

For spatial strategies, experimental participants employed mainly list strategy (55%); 33% of descriptions used perimeter strategy; and only 7% used object-to-object strategy, which all used in CCB campus descriptions. Control group results differed: 68% perimeter strategy and only 32% list strategy. In terms of spatial models, most research participants used a route model in their descriptions (experimental 59%, control 68%); only 7% of the experimental participants used a map model. In the chronological approach, all participants started their description with structural components. No data are available for 13% of the verbal descriptions because of technical problems.

Research question 2

In the first orientation tasks the control group was faster than the experimental group (for instance, in M3 it was faster in five of eight tasks). But in later sessions the experimental group was faster (for

Table 1
Real space object-oriented (1 & 2) and reverse tasks (1R & 2R) performance.

							Problem solving			
		Task	Time (seconds)	Successful completion	Direct path	Perimeter strategy	Landmark	Travel for more information	Going back to starting point	Stop and think
M3	Experimental	1	85	89%	89%	98%	33%	11%	11%	11%
		1R	64	75%	63%	92%	25%	13%	13%	13%
		2	103	63%	50%	94%	13%			13%
		2R	75	57%	57%	92%	14%		14%	14%
	Control	1	96	60%	40%	94%	20%			40%
		1R	61	80%	60%	97%	20%		20%	60%
		2	84	40%	40%	89%				40%
		2R	51	60%	40%	100%			20%	
MB	Experimental	1	82	75%	88%	97%	13%		13%	25%
		1R	70	75%	75%	95%	13%	13%	13%	
		2	161	71%	57%	94%	57%		29%	29%
		2R	48	100%	86%	96%				
	Control	1	33	80%	60%	97%	60%			20%
		1R	34	40%	60%	100%	20%			
		2	55	80%	80%	100%				
		2R	36	80%	80%	100%				
DB	Experimental	1	37	100%	83%	86%				17%
		1R	28	100%	100%	83%				
		2	82	83%	100%	78%	17%			
		2R	66	100%	83%	73%				17%
	Control	1	32	100%	100%	100%	20%			
		1R	30	100%	100%	100%				
		2	164	60%	40%	100%	20%		20%	20%
		2R	77	80%	60%	97%				
CCB1	Experimental	1	51	88%	88%	91%	25%			
	Control	1	50	100%	100%	87%				
CCB3	Experimental	1	84	89%	89%	86%	22%			
	Control	1	147	100%	100%	85%	40%			60%

Note: Perimeter strategy and second hand are indicated in percentages of the overall time of exploration. Successful completion, direct path, and problem solving are indicated in the participants' percentages.

instance, in DB it was faster in six of eight tasks). Similarities appeared in object-oriented, perspective-taking, and reverse tasks.

Table 1 presents the real space performances of object-oriented tasks and their reverse. Table 2 presents the performances of perspective-taking tasks and their reverse. Both tables present the task averages for the participants. Comparison between the research groups on the overall tasks shows that the experimental participants were more successful in 73% of the tasks, especially in the perspective-taking and reverse tasks (indoor and outdoor spaces). Comparing task performance with reverse tasks shows more improvement in the reverse tasks for the experimental group than for control participants (in all MB tasks, 62% of the experimental group performed tasks successfully and 94% succeeded in the reverse tasks, while 50% of the control group succeeded in the initial tasks, and 45% succeeded in reverse tasks). Comparing success between object-oriented and perspective-taking tasks reveals more success for all in the object-oriented

Table 2
Real space perspective-taking (1 & 2) and reverse tasks (1R & 2R) performance.

							Problem solving			
		Task	Time (seconds)	Successful completion	Direct path	Perimeter strategy	Landmark	Travel for more information	Going back to starting point	Stop and think
M3	Experimental	1	80	67%	67%	93%	33%	11%	33%	22%
		1R	34	100%	100%	95%				
		2	85	63%	50%	99%	25%		25%	50%
		2R	51	100%	83%	80%	17%		17%	
	Control	1	35	40%	40%	100%				
		1R	36	40%	40%	100%				
		2	90	40%	40%	100%				20%
		2R	23	40%	40%	100%				
MB	Experimental	1	66	75%	88%	96%	25%		38%	63%
		1R	58	100%	75%	100%	38%		13%	
		2	158	28%	28%	97%	43%	14%	28%	43%
		2R	42	100%	83%	100%	33%			
	Control	1	45	40%	40%	100%				
		1R	29	60%	60%	100%				
		2	12	0						20%
		2R	-	0						
DB	Experimental	1	73	100%	100%	80%	33%		33%	17%
		1R	72	100%	100%	67%	17%			
		2	77	83%	83%	74%	17%			34%
		2R	46	100%	100%	58%	17%			
	Control	1	182	80%	40%	79%	20%			60%
		1R	99	80%	40%	92%		20%		20%
		2	64	40%	60%	84%				20%
		2R	74	40%	40%	84%				
CCB1	Experimental	1	190	78%	67%	89%	33%	11%		33%
		1R	214	56%	56%	91%	78%	11%		44%
	Control	1	160	60%	80%	100%	20%			60%
		1R	187	80%	60%	95%	20%	20%	20%	60%
CCB3	Experimental	1	563	67%	56%	97%	89%	33%		56%
		2	434	67%	22%	94%	56%	56%		56%
	Control	1	731	60%	20%	94%	80%	20%		80%
		2	649	40%	20%	95%	80%	40%		60%

Note: Perimeter strategy and second hand are indicated in percentages of the overall time of exploration. Successful completion, direct path, and problem solving are indicated in the participants' percentages.

tasks; the difference was greater for the control group (76% object-oriented; 46% perspective-taking).

Most experimental participants took direct paths to the targets (in all M3 tasks, 70% of the experimental group used direct paths compared to 43% of the control group). Both research groups improved path directness from tasks to reverse tasks. Both research groups used direct paths more in object-oriented tasks, with wider differences in the control group (69% object-oriented; 44% perspective-taking). Path differences mainly appeared in CCB3. This space included three tasks: from technology center (Figure 2, #1) to dormitory (#2); from dormitory to bus stop (#4); and from bus stop to main building (#3) west door. During this task the control participants expressed frustration and fear regarding walking outside the campus, taking short steps and

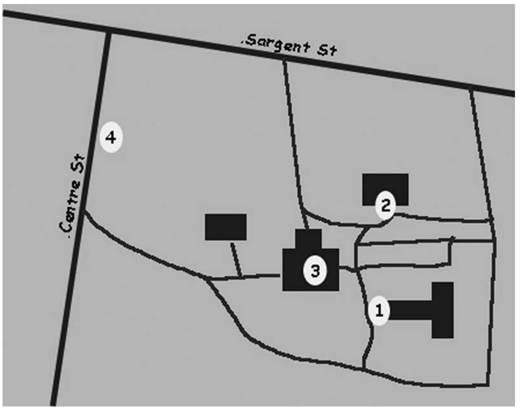

Figure 2. Orientation tasks on the Carroll Center for the Blind campus—3rd session (1 = technology center; 2 = dormitory; 3 = main building; and 4 = bus stop).

making many stops. All participants used the same paths for the first and third tasks. Path differences appeared mainly in the second task. Most of the experimental participants (89%) chose longer public paths outside the center, while 60% of the control group preferred to walk within the campus and to take only shorter public paths.

Both groups mainly chose perimeter strategy during all tasks (90%–100% of duration). However, experimental participants briefly used other spatial strategies, mainly in the DB task.

During orientation tasks participants held the long cane in their dominant hand, using their second hand to explore the space. All participants used their second hand in the same duration percentages, but the experimental group used it most in the tasks, and the control group used it mainly in the reverse tasks. Use of the second hand decreased in later sessions. Thus, in M3 both research groups used their second hand during 31%–32% of task duration, and in CCB3 both research groups used it only 9% of task duration. Both research groups used their second hand mainly in object-oriented tasks (indoor and outdoor spaces).

During the tasks, participants used orientation problem-solving strategies. The percentages in Tables 1 and 2 present the participants' averages using problem-solving strategies. Experimental participants used three times more landmarks (object, ground texture, audible, or cardinal) during task performance than did control participants. In M3, the experimental participants used more landmarks than did control participants; similar results occurred in DB and CCB campus. Participants used landmarks mainly in initial tasks as opposed to reverses. A comparison between object-oriented and perspective-taking tasks reveals that experimental participants used more landmarks than did control participants, especially in perspective-taking tasks. "Travel for more spatial information" was used more by experimental participants, especially in the initial spaces (M3, MB). No differences were found using the "travel for more information" strategy among tasks in indoor spaces, but in the outdoor space it was used mainly in perspective-taking tasks. "Going back to the starting point" was used four times more by experimental participants, especially in M3 and MB. In outdoor spaces all participants used this strategy less often. In indoor spaces "stop & think" was used more by the control group in object-oriented tasks and by the experimental group in perspective-taking tasks, and used less often by both groups in the reverse tasks. In the outdoor space the control group used this strategy more frequently.

For the last task, each participant pointed at five to six objects. In all the indoor spaces the experimental group pointed

more accurately (M3 81%, MB 76%, and DB 97%) compared to the control group (M3 56%, MB 68%, and DB 79%). In the CCB campus task, 67% of experimental participants pointed successfully at object locations compared to 83% of control participants.

Discussion

This research is the first to examine the integration of a virtual environment in an O&M course to support blind and visually impaired people in practicing and obtaining O&M skills. Results indicate the contribution of BlindAid to the experimental group's greater capability in performing orientation tasks in real space. This study elucidates two main issues concerning the contribution of BlindAid to an O&M training program.

BlindAid as O&M simulator integrated in an O&M course

BlindAid allowed the experimental group to practice basic O&M skills in exploring, collecting, and constructing a cognitive map, and transferring this knowledge to real spaces without limitation. Practice using BlindAid enables successful real space task performances, shorter performance duration, use of direct paths, and employment of spatial strategies other than perimeter. These results differ from those of Munro, Breaux, Patrey, & Sheldon (2002), who reported participants' difficulties and unsuccessful performance of orientation tasks in real space. In contrast, these findings demonstrate the ability to explore a real space in advance through a virtual environment, and to use orientation strategies and sensory landmarks within it, as was reported in studies on spatial performance with people who were congenitally or adventitiously totally blind (Lahav & Mioduser, 2004) or those who had low vision (Parente & Bishop, 2003; Sánchez et al., 2008).

Moreover, BlindAid assists in the practice of spatial problem-solving strategies. For example, during orientation tasks, when participants did not know how to reach a target they used one of the problem-solving strategies that they had practiced in BlindAid simulation. Conversely, control participants failed to conclude the tasks. Experimental participants used all types of sensory and conceptual strategies, collecting and using sensory landmarks or cardinal landmarks, as suggested in the Carroll Center O&M curriculum (Campbell, 1992a, 1992b), and other techniques such as returning to the start to relocate themselves. Both research groups' verbal descriptions and orientation task performance improved throughout the research, but throughout the study the experimental group performed better in most of the orientation tasks, especially in the perspective-taking and reverse tasks. Seki and Sato (2011) found similar results in research on O&M training using an acoustic virtual environment, suggesting that exploring the virtual environment reduced the stress of exploring real space.

Spatial awareness

Integrating BlindAid into an O&M course motivated experimental participants to actively explore and be aware of their environments. After three weeks using BlindAid, some experimental participants from the Independent Living Program demonstrated a desire to know more about their surroundings, and they developed a game during their free time in the Carroll Center's outdoor space. The game's leader observed,

> People were lost all the time . . . they are right here on grounds . . . they didn't know, from this building to that building . . . is all they knew. . . . They didn't know anything else out here, so I [walked] them around in the parking lot and [told] them what things were; then we start[ed] playing a game with it. . . . Everybody just blindfolded themselves, including me, and we [gave] each other tasks. . . . It's a lot of fun. . . . That's how I got to know the grounds real well, and I can walk them fairly well [now].

Moreover, during the CCB3 second orientation task most of the experimental participants chose public paths outside the campus to get directly to the target more quickly. These differences might be based on the differences that were found between the research groups in familiar outdoor environments—most of the experimental group preferred using a long cane, while most of the control group preferred being accompanied by a sighted person. Although for some participants it was their first time walking on the path, no differences were found between the research groups in unfamiliar outdoor environments. Most control participants chose a longer path inside the campus. This ability to be aware, examine, and choose among optional paths indicates a higher level of spatial ability and a greater confidence in their O&M skills.

Implications for researchers and practitioners

The encouraging results of the current study indicate the potential strengths of the virtual environment system as an O&M training aid for blind and visually impaired people. Further research and development should explore virtual echolocation feedback as a training method and examination of this technique for visually impaired persons as a spatial tool for O&M training in real spaces. Research and development of a device to allow exploration of spaces in advance of and during navigation of real environments is also needed. Finally, future research needs to explore a research instrument that would allow spatial knowledge to be expressed without verbal description or drawing.

After further research, BlindAid could play a central role in three potential applications. First, an O&M training simulator could allow practice of O&M skills with extra time in a safe environment. Second, an O&M diagnostic tool could allow O&M specialists to track and observe participants' spatial behavior, such as O&M skills, spatial strategy, and O&M problem solving. Finally, BlindAid could be available on the Internet (as are maps for sighted people) to support visually impaired people in the virtual exploration of spaces.

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Statistical Sidebar

Control Groups and Experimental Groups: It Is All in the Numbers

In this issue of the journal, the article, "Virtual Environment for People Who Are Blind Integrated in an Orientation and Mobility Program," by Orly Lahav, David W. Schloerb, and Mandayam A. Srinivasan, uses an experimental procedure that typically appears in the characteristics of what scientists think of

Editor's Note: In a recent survey, we learned that an overwhelming majority of readers of the Journal of Visual Impairment & Blindness (JVIB) *would enjoy a brief feature that explains the statistics and findings of research articles. In an effort to increase readers' level of comfort with statistics and to make results sections more approachable, we have, with the generous assistance of Robert Wall Emerson, Ph.D., resurrected the Statistical Sidebar feature.*

